

IN THE SPECIFICATION:

Please replace paragraph number [0011] with the following rewritten paragraph:

[0011] In another embodiment, the reactive material includes cyclotetramethylene tetranitramine, cellulose acetate butyrate, and (bis(2,2-dinitropropyl)acetal/bis(2,2-dinitropropyl) formal). In another embodiment, the reactive material includes aluminum, potassium perchlorate, silicon, and a thermoplastic terpolymer of tetrafluoroethylene, hexafluoropropylene, and vinylidene fluoride. In another embodiment, the reactive material includes bismuth, indium, tin, aluminum, silicon, sulfur, potassium perchlorate, bisazidomethyloxetane, glycidylazide plasticizer, and (bis(2,2-dinitropropyl)acetal/bis(2,2-dinitropropyl)formal). In another ~~embodiment~~ embodiment, the reactive material includes cyclotetramethylene tetranitramine, cellulose acetate butyrate, (bis(2,2-dinitropropyl)acetal/bis(2,2-dinitropropyl)formal), aluminum, potassium perchlorate, silicon, and a thermoplastic terpolymer of tetrafluoroethylene, hexafluoropropylene, and vinylidene fluoride. In another embodiment, the reactive material includes zirconium and a thermoplastic terpolymer of tetrafluoroethylene, hexafluoropropylene, and vinylidene fluoride.

Please replace paragraph number [0020] with the following rewritten paragraph:

[0020] A reactive material ~~that~~ that is suitable for use in a projectile is disclosed. Upon initiation, the reactive material produces an energy output or release that is greater than the energy output of the fill material used in the MK211 projectile. The reactive material may also have a higher density than that of a conventional fill material. The reactive material may be a high energy pyrotechnic composition. As used herein, the term “pyrotechnic composition” refers to a composition that produces light, heat, motion, noise, pressure, or smoke when initiated. The reactive material may be used as a fill material in the projectile, such as in a bullet. The reactive material may provide enhanced performance to a projectile in comparison to that provided by conventional fill materials, in at least one of pressure release, earlier initiation, later initiation, fireball intensity, and target damage. By modifying the components and their relative amounts in

the reactive material, the energy release of the reactive material may be tailored to specific target requirements so that damage to a target having known or projected characteristics may be maximized. Furthermore, by varying mechanical properties, such as material and configuration of a case and tip of the reactive material projectile, and matching those mechanical properties with a selected reactive material of the present invention, tailorable initiation and energy release may be achieved.

Please replace paragraph number [0025] with the following rewritten paragraph:

[0025] The oxidizer may be present in the reactive material from approximately 10% to approximately 81%, depending on the oxidizer used. The oxidizer used in the reactive material may be an inorganic oxidizer, such as an ammonium nitrate, an alkali metal nitrate, an alkaline earth nitrate, an ammonium perchlorate, an alkali metal perchlorate, an alkaline earth perchlorate, an ammonium peroxide, an alkali metal peroxide, or an alkaline earth peroxide. The inorganic oxidizer may include, but is not limited to, ammonium perchlorate (“AP”), potassium perchlorate (“KP”), potassium nitrate ( $\text{KNO}_3$ ), or strontium nitrate ( $\text{SrNO}_3$ ). The inorganic oxidizer may have a particle size ranging from approximately 1  $\mu\text{m}$  to approximately 250  $\mu\text{m}$ . The perchlorate or nitrate inorganic oxidizer may be present from approximately 10% to approximately 90%. The inorganic oxidizer may also be a transition metal-based oxidizer, such as a copper-based, an iron-based, or a molybdenum-based oxidizer, that includes, but is not limited to, basic copper nitrate ( $[\text{Cu}_2(\text{OH})_3\text{NO}_3]$ ) (“BCN”), cupric oxide ( $\text{CuO}$ ), iron oxide ( $\text{Fe}_2\text{O}_3$ ), or molybdenum trioxide ( $\text{MoO}_3$ ). The transition metal-based oxidizer may be present from approximately 18% to approximately 78%. The transition metal-based oxidizer may have a particle size ranging from approximately 20 nm to approximately 200  $\mu\text{m}$ . The oxidizer may also be a ~~non~~-nonoxygen containing compound, such as sulfur or a fluoropolymer, such as PTFE, a thermoplastic terpolymer of tetrafluoroethylene, hexafluoropropylene, and vinylidene fluoride (“THV”), or a fluoroelastomer. Examples of fluoropolymers include, but are not limited to Telfon<sup>®</sup>, which is available from DuPont (Wilmington, DE), THV220 or THV500, which are available from Dyneon LLC (Oakdale, MN), and Viton<sup>®</sup>, which is a copolymer of

vinylidene fluoride-hexafluoropropylene and is available from DuPont Dow Elastomers LLC (Wilmington, DE). The fluoropolymer may also function as a binder in the reactive material. The fluoropolymer may be present from approximately 5% to approximately 74%.

Please replace paragraph number [0031] with the following rewritten paragraph:

[0031] While the reactive material may be used as the fill material in a bullet, the reactive material may also be used in other munitions, such as in mortars or as a bombfill. For the sake of example only, the reactive material may be used ~~in~~ in a projectile, such as the ballistic projectiles disclosed in United States Patent No. 4,419,936 to Coates *et al.* The reactive material may also be used in a 0.50 caliber bullet. For instance, the reactive material may be used in a bullet that is designed to penetrate a thin-skinned target having a wall thickness of at least 0.064 inches. However, the reactive material may also be used in a bullet that is designed for greater penetration, such as into a thicker-skinned target having a wall thickness of up to approximately 7/8-inch. The reactive material may also be used as the fill material in other 0.50 caliber casings, such as in the MK211, M8, or M20 casings. The reactive material may also be used in medium caliber projectiles, such as, for example, in 35mm, 30mm, 25mm and 20mm cannon rounds, and in small caliber projectiles, such as, for example, in 0.223 caliber, 0.308 caliber, 0.45 caliber, and 9 mm bullets. The reactive material may also be used in larger caliber guns that provide direct or indirect fire.

Please replace paragraph number [0033] with the following rewritten paragraph:

[0033] When the reactive material bullet 2 is fired at a target, the mass and velocity of the reactive material bullet 2 may provide sufficient energy for the reactive material bullet 2 to penetrate the target. The material and configuration of the tip 6 may be selected in relation to the wall thickness of the intended target. The initial impact of the reactive material bullet 2 with the target may initiate or ignite the reactive material 8. As the tip 6 of the reactive material bullet 2 begins to penetrate the target, the tip 6 may be pushed back into the reactive material 8 and the shock of impact, as conveyed to the reactive material 8 by the tip 6, used to initiate the reactive

material 8. If the target is, for ~~example~~ example, a fuel tank or other container holding a volatile liquid, the impact may initiate reaction of the reactive material 8 as the tip 6 punctures the fuel tank, enabling fuel or other volatile liquid to escape and aerosolize in the atmosphere. As the reactive material bullet 2 continues to penetrate the target, the case 4 may be ruptured by the ongoing reaction of the reactive material 8, expelling hot burning material into the vaporized fuel or other volatile liquid and igniting the fuel. Since the reactive material 8 may be initiated by the shock of impact of reactive material bullet 2 with the target, inclusion in reactive material bullet 2 of a separate initiation mechanism (such as a fuse or primer) for the reactive material 8 may not be necessary. While the reactive material 8 may be initiated on thin-skinned targets, such as targets having walls made of 1/16-inch steel, projectiles using reactive material 8 may also be used to penetrate thicker-skinned targets, such as those up to 7/8-inch steel wall thickness.

Please replace paragraph number [0035] with the following rewritten paragraph:

[0035] In one embodiment, the reactive material includes a mixture of 90% by weight (“wt%”) Hf powder and 10 wt% THV220, which is designated as Formulation 1943-32-12. Formulation 1943-32-12 provides a large fireball/plume size when ignited and also provides extensive target damage. In another embodiment, the reactive material provides a high-pressure release and includes a mixture of PAX-2A (86.6% HMX, 8% BDNPA/F and 5.4% cellulose acetate butyrate) and Formulation 1943-37A (13.7% THV220 fluoropolymer, 27.45% aluminum powder, 44.56 % potassium perchlorate, and 14.29% silicon). The reactive material included a mixture of 50% by volume PAX-2A and 50% by volume Formulation 1943-37A. A sandwich of this reactive material was formed by first pressing the PAX-2A and then pressing the Formulation 1943-37A on top of the pressed ~~PAX~~ PAX-2A to give a reactive material having 30% by weight PAX-2A and 70% by weight Formulation 1943-37A.

Please replace paragraph number [0041] with the following rewritten paragraph:

Example 2

Safety Testing of the Reactive Material Formulations

[0041] Safety testing was performed on the reactive material formulations described in Example 1. Friction properties of the formulations were measured using a friction test developed by Allegheny Ballistics Laboratory (“ABL”). Onset of ignition exotherms and sensitivity to elevated temperatures of the formulations ~~was~~ were measured using a Simulated Bulk Autoignition Test (“SBAT”). Electrostatic discharge (“ESD”) of the formulations was measured using an ESD test developed by Thiokol Corporation (“TC”). Impact properties of the formulations were measured using an impact test developed by TC and an impact test developed by ABL. Deflagration to detonation (“DDT”) transitions of the formulations was also measured. These tests are known in the art and, therefore, details of these tests are not included herein. The safety properties were used to determine whether the reactive materials had a low level of sensitivity (green line (“GL”)), an intermediate level of sensitivity (yellow line (“YL”)), or a high level of sensitivity (red line (“RL”)). The overall rating assigned to each of the reactive materials is the lowest (most conservative) rating received from the safety tests.

Please replace paragraph number [0045] with the following rewritten paragraph:

[0045] Energy release and initiation threshold of the reactive material formulations ~~was~~ were determined by firing the reactive material bullets 2 from a ~~50-50~~-caliber gun 10 into a series of steel plates having a thickness of 1/8-inch at ATK Thiokol’s hundred-yard test range, which is schematically shown in FIG. 2. The steel plate array included three, 1/8-inch-thick, carbon steel witness plates 12 in series followed by a 1/2-inch-thick, carbon steel backer plate 14. The distance between each steel plate was 6 inches. The plates were rigidly held together using steel rods and 6-inch spacers and were mounted on a steel stand.

Please replace paragraph number [0048] with the following rewritten paragraph:

[0048] Pressure-versus-time profiles for the reactive material bullets that included the ~~formulations~~ formulation Nos. 1791-100-2, 1791-100-2, 1943-32-13, 1943-32-12, 1943-32-11, 1943-32-03, 1943-32-03, 1943-32-07, 1943-32-07, 1943-32-12, PAX-2A, and PAX-2A are shown in FIGs. 3-14, respectively. Still photos taken from high-speed video for the reactive material bullets that included the ~~formulations~~ formulation Nos. 1791-100-2 (bullet for thin-skinned targets), 1791-100-2 (bullet for thicker-skinned targets), 1943-32-13 (bullet for thin-skinned targets), 1943-32-13 (bullet for thicker-skinned targets), 1943-32-11 (bullet for thicker-skinned targets), 1943-32-03 (bullet for thin-skinned targets), 1943-32-03 (bullet for thicker-skinned targets), 1943-32-07 (bullet for thin-skinned targets), 1943-32-07 (bullet for thicker-skinned targets), 1943-32-12 (bullet for thin-skinned targets), 1943-32-12 (bullet for thicker-skinned targets), 1943-32-01 (bullet for thin-skinned targets), 2002-1-1 (bullet for thin-skinned targets), 1943-34D (bullet for thin-skinned targets), 1943-34E (bullet for thin-skinned targets), PAX-2A (bullet for thin-skinned targets), 1943-37A (bullet for thin-skinned targets), 1943-37B (bullet for thin-skinned targets), and PAX-2A & 1943-37A (bullet for thin-skinned targets) are shown in FIGs. 15-33, respectively.

Please replace paragraph number [0049] with the following rewritten paragraph:

[0049] The IR intensity-versus-time profiles for the reactive material bullets that included the ~~formulations~~ formulation Nos. 1791-100-2, 1791-100-2, 1791-100-2, 1943-32-13, 1943-32-11, 1943-32-03, 1943-32-03, 1943-32-07, 1943-32-07, 1943-32-07, 1943-32-12, 2002-1-1, 1943-34D, 1943-34E, PAX-2A, PAX-2A, 1943-37A, 1943-37A, 1943-37B, and PAX-2A & 1943-37A are shown in FIGs. 34-53, respectively.